

# The Status of Pollinators in North America (NAS-NRC) & An update on Stingless Bee Conservation in the Yucatan



Quiz: not a stingless bee...

# Stephen Buchmann



- Depts. of Entomology & Ecology & Evolutionary Biology, University of Arizona, Tucson
- International Coordinator, North American Pollinator Protection Campaign (NAPPC) ([www.napppc.org](http://www.napppc.org)) & ([www.pollinator.org](http://www.pollinator.org))
- [stephenbuchmann@comcast.net](mailto:stephenbuchmann@comcast.net)

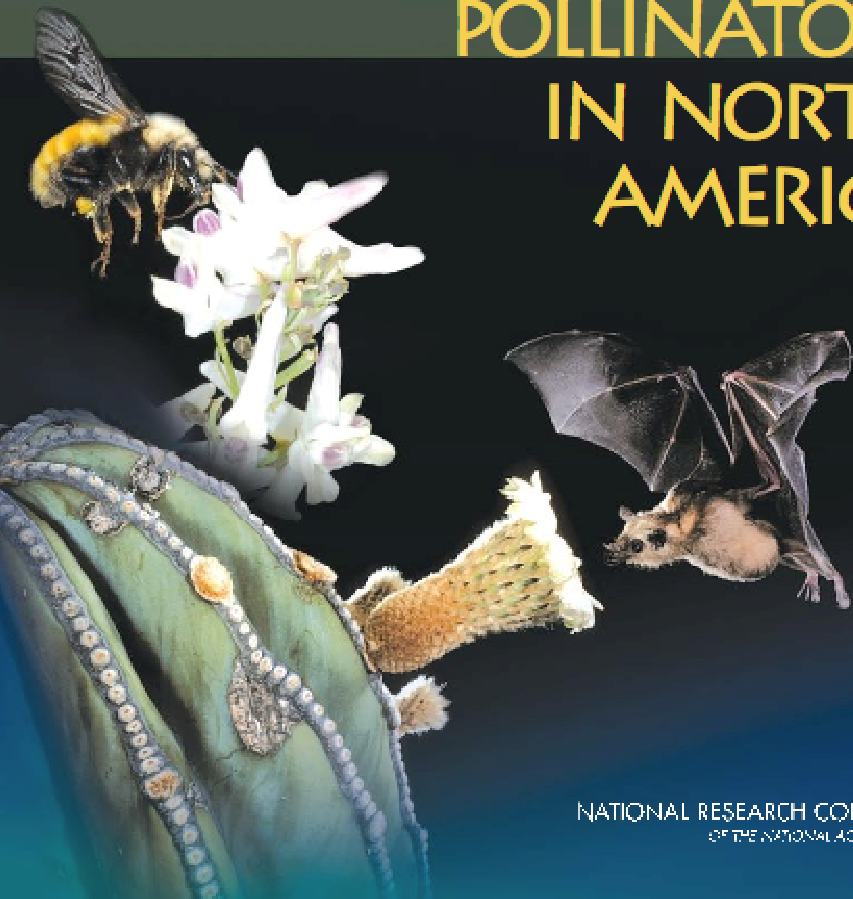


Remember the famous  
pollen moustache  
ads on television?





## STATUS OF POLLINATORS IN NORTH AMERICA



NATIONAL RESEARCH COUNCIL  
OF THE NATIONAL ACADEMIES

# The National Academies, NATIONAL RESEARCH COUNCIL

Report (300 page book)  
published during April, 2007

Read it online (free), or  
book and/or .pdf file  
can be purchased from  
NAS or NAPPC

[http://books.nap.edu/catalog.php?record\\_id=11761](http://books.nap.edu/catalog.php?record_id=11761)



# The Status of Pollinators (NAS-NRC)

- >18 months in the making! :-)
- A cast of thousands (would you believe 15?)
- A production/printing budget of nearly \$500K  
(Funded by USDA-ARS, DOI-USGS, NAS and govt. printing office)
- Committee met face-to-face 5 times in multi-day sessions, more conf. calls and e-mails than I care to recall...
- Request for study came from the North American Pollinator Protection Campaign (in early 2002).

## 15 ad hoc Committee Members:

May Berenbaum\*, Peter Bernhardt,  
Stephen Buchmann, Nicholas Calderone, Paul Golstein,  
David Inouye, Peter Kevan, Claire Kremen, Rodrigo Medellin,  
Taylor Ricketts, Gene Robinson, Allison Snow, Scott  
Swinton, Leonard Thien & Christian Thompson

### NAS Staff:

Evonne Tang, Study Director  
Frances Sharples, Director, Board on Life Sciences,  
Peggy Tsai, Assoc. Prgm. Officer  
Karen Imhoff, Admin. Assistant

Our thanks to the 10  
“Anonymous” Reviewers!!  
(to NAS committee members during  
study)



Deane Bowers, Susan Mazer, Robert Page,  
Peter Raven, Malcolm Sanford, \*Marla Spivak,  
\*James Thomson, \*Nickolas Waser, Don Wilson  
and Ada Wossink

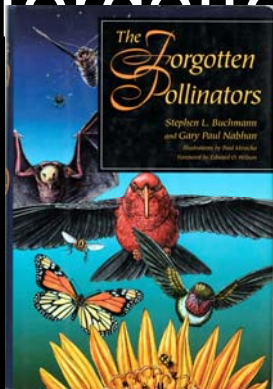


# Why the NAS Study?



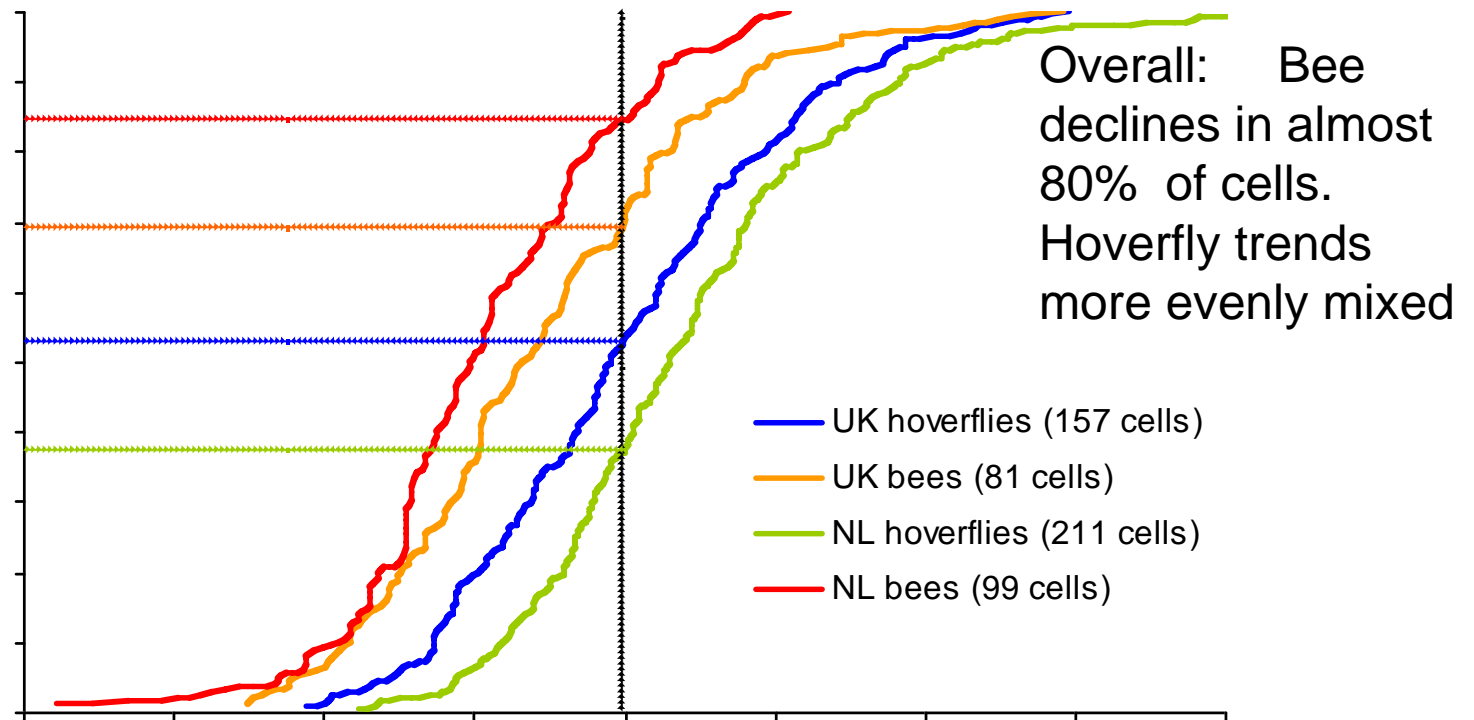
- Do we face a N. American pollinator crisis?
- Are declines in bees and flower flies from U.K. & the Netherlands happening in N. America, but we lack baseline data?

“The evidence is overwhelming that wild pollinators are declining around the world. Most have already experienced a shrinking of range. Some have already suffered or face the imminent risk of total extinction. Their ranks are being thinned not just by habitat reduction and other familiar agents of impoverishment, but also by the disruption of the delicate “biofabric” of interactions that bind ecosystems together. Humanity, for its own sake, must attend to the forgotten pollinators and their countless dependent plant species.”



Edward Wilson, Foreword to  
The Forgotten Pollinators, 1996

# We've seen the handwriting on the wall (from Europe)



	Bees
UK	<b>Decline</b> ( $X^2=11.7$ , $p<0.001$ )
NL	<b>Decline</b> ( $X^2=65.2$ , $p<0.001$ )
	<b>NL &lt; UK</b> ( $X^2=14.7$ , $p<0.001$ )

	Hoverflies
	No direction ( $X^2=0.03$ , $p=0.85$ )
	<b>Increase</b> ( $X^2=37.8$ , $p<0.001$ )
	<b>UK &lt; NL</b> ( $X^2=16.5$ , $p<0.001$ )





# A major obstacle to understanding the extent of pollinator declines in N. America...

- Lack of well-established baseline data from standardized pollinator surveys for U.S.A. and other regions of N. Amer. Need for multi-year time series (3 years minimum, decades even better). Bee and other insect populations can fluctuate wildly.
- European Union countries are well ahead of us (ALARM project) and well-funded, almost 26 million Euros.



# Charge to the Committee

- Whether and to what degree pollinators are experiencing serious decline (for N. America).
- In cases where decline can be established by avail. data, what its causes are.
- What the potential consequences of such declines might be in both agricultural & natural ecosystems.
- Make recommendations on research & monitoring needs (to USDA & USGS, NSF etc.).
- Conservation/restoration steps that could prevent, slow or reverse potential declines.

# Geographic Areas Evaluated

- “North America”
- Defined as continental Canada, United States and Mexico.
- But NOT Hawaiian islands, Puerto Rico or other U.S. territories outside lower 48.
- Ask me why over a beer...





# NAS-NRC Report (Book) Outline (7 chapters)

## 1. ROLE AND IMPORTANCE OF POLLINATORS

Pollinators in Natl. & Agric. Ecosystems

Population Management

Value of Pollination

State of Knowledge

History of Concern

Charge to the Committee



## 2. STATUS OF POLLINATORS

Pollinators and the Concept of Decline

Population Trends

### 3. CAUSES OF POLLINATOR DECLINES AND POTENTIAL THREATS

Decline in Actively Managed Pollinators  
Decline in Natural or Wild Pollinators

### 4. EFFECTS OF VARIATIONS IN POLLINATOR POPULATIONS ON POLLINATION SERVICES

Pollinators in Agriculture  
Pollinators in Natural Areas



## 5. MONITORING POLLINATOR POPULATIONS AND SERVICES

Review and Assessment of Current Monitoring Programs  
Requirements for Adequate Monitoring of Pollinators and  
Pollination Function

## 6. STRATEGIES FOR MAINTAINING POLLINATORS AND POLLINATION SERVICES

Maintaining Commercial Pollinators

Maintaining Wild Pollinators

Public Policy and Pollinator Populations

Adaptive Management and Pollinator Monitoring



## 7. FINDINGS AND RECOMMENDATIONS

For Managed Pollinators

For Wild Pollinators

Backmatter:

Glossary, References, Appendices

(including extinct insects, endangered insects, bee species in decline, invasive bees, **\*Xerces Society Red List** of pollinating insects of North America; butterflies and bees)



There isn't time to cover everything,  
but here are the main points & NAS  
recommendations...



# Evidence of Pollinator Declines (with quantitative data)

**Table 2-6** Illustrative examples of pollinators in North America for which evidence of decline is available.

Species for which quantitative data are available.

Common name	Species name	Location
Hymenoptera		
Honey bee	<i>Apis mellifera</i>	United States
Honey bee	<i>A. mellifera</i>	Mexico
Franklin's bumble bee	<i>Bombus franklini</i>	Pacific Northwest of the United States
Western bumble bee	<i>B. occidentalis</i>	Central California
Bumble bee	<i>B. affinis</i>	New York
Lepidoptera		
Bay checkerspot butterfly	<i>Euphydryas editha bayensis</i>	Palo Alto, California and other localities
Chiroptera		
Long-nosed bat	<i>Leptonycteris curasoae</i>	United States and Mexico
Long-nosed bat	<i>L. nivalis</i>	United States and Mexico
Apodiformes		
Rufous Hummingbird	<i>Selasphorus rufus</i>	United States and Canada
Allen's Hummingbird	<i>S. sasin</i>	United States

### Species for which quantitative data are not available

Common name	Species name	Location
Hymenoptera		
Stingless bees	<i>Melipona spp.</i> <i>Trigona spp.</i>	Southern Mexico
Pollen wasps	<i>Pseudomasaris micheneri</i>	Inyo County, California
Pollen wasps	<i>P. macswaini</i>	
Chiroptera		
Hog-nosed bat	<i>Choeronycteris mexicana</i>	Mexico
Banana bat	<i>Musonycteris harrisoni</i>	Mexico





# Unfortunately, we are losing pollinators around the world (e.g. HIPPO)

- **H**abitat destruction and degradation
- **I**nvasion of alien plants & animals into nonnative habits
- **P**ollution of all kinds
- **P**opulation expansion (by human)
- **O**verharvesting (more common for vertebrates than insects)



**Sadly, to this ever-growing list, we now must add Global Change (warming)**

## Yes, there have been pollinator extinctions in N. America

- Lepidoptera (Xerces Blue, Palos Verdes Blue, likely the Lotis Blue; 6 Noctuid moths, 1 Ermine and 2 Chestnut moths). A total of 19 extinct insects (likely an underestimate) recognized by the IUCN.
- Bees (likely *B. franklini* in pacific NW and at least 7 spp. of yellow-faced bees, *Hylaeus* from Hawaii).

# Other Pollinators & Some Plants are Threatened to Various Degrees...

- Please visit IUCN, IABIN, PCDL and Xerces online databases and other resources.
- Xerces [Red List of Pollinator Insects of North America](#) (butterflies and bees).
- The Lotis Blue is possibly extinct, while 26 other leps are Critically Imperiled and 13 others are categorized as Imperiled.
- For bees, 8 species are likely extinct (1 *Bombus* and 7 *Hylaeus*), 20 species are Critically Imperiled, another is Imperiled and 20 spp. are considered Vulnerable (these include *Bombus affinis*, *B. lucorum*, *B. occidentalis* and *B. terricola*).

# Disappearing *Bombus* in USA and Canada

- *Bombus franklini* is likely **extinct** (not seen in 5 years) by R.W. Thorp and others.
- *Bombus occidentalis* & *B. affinis* are rapidly disappearing from their western and eastern ranges. Until very recently, they were widespread bees. Other species in the subgenus *Bombus* are similarly threatened.
- Pathogen spillover (*Crithidia* & *Nosema* seem to be the causes, escape from greenhouse populations of *B. impatiens*).
- NAPPC white paper on perils of *Bombus* introductions.

# Not all bees evolved equal...

- 23 species of exotic bees in 14 genera are now established in the United States, and sometimes compete for nest sites (e.g. *Apis*) with birds, limiting floral resources or for nesting substrates.



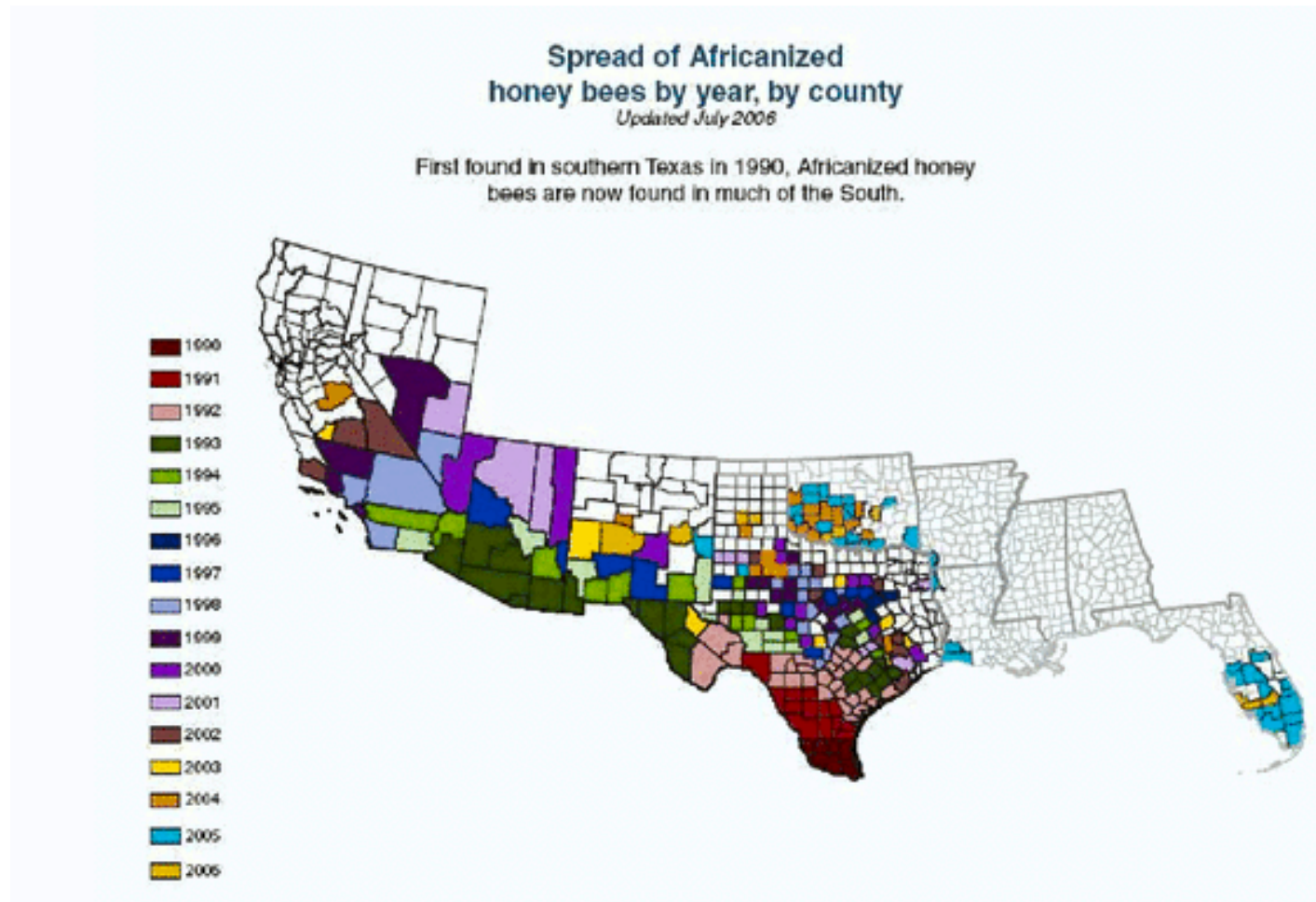


## 23 Species of Exotic Bees are now established (naturalized) in the United States.

*Andrena wilkella*, *\*Apis mellifera*, *\*Anthophora plumipes*,  
*Ceratina cobaltina*, *Ceratina dalltoreana*, *Centris eisenii*,  
*Euglossa viridissima*, *Xylocopa tabiniformis*, *Hylaeus bisinuatus*,  
*Hylaeus hyalinatus*, *Hylaeus punctatus*, *Anthidium manicatum*,  
*A. oblongatum*, *Chelostoma campanularum*, *Chelostoma fuliginosum*,  
*Hoplites anthocopoides*, *Lithurgus chrysurus*, *Megachile apicalis*,  
*Megachile concinna*, *Megachile rotundata*, *\*Megachile sculpturalis*,  
*Osmia coerulescens*, *Osmia cornifrons*,  
*Osmia cornuta*

(Note- most of these nest in wood)  
\*\*\*We must keep exotic *Bombus* spp. out!

# Invasive Bees

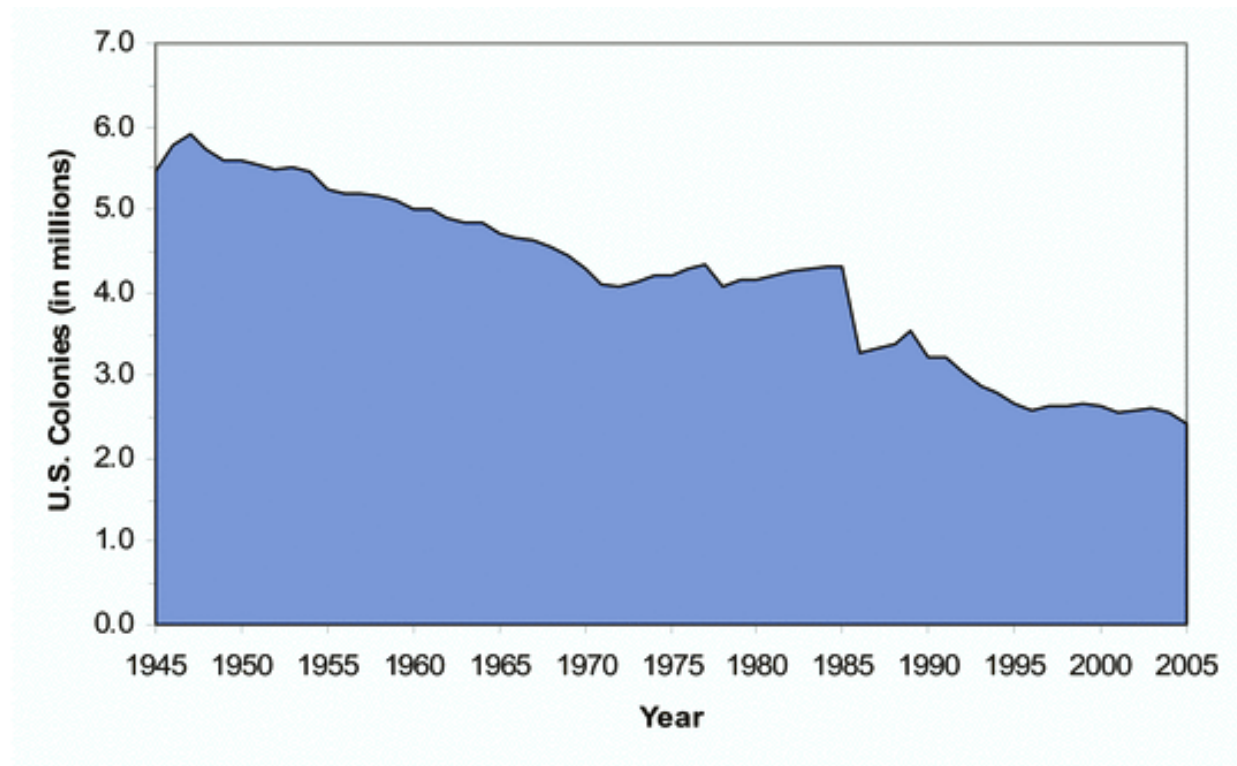


# Status of Managed Pollinators: Bees

- USDA-NASS has kept records of honey bee population (managed col. #'s) since 1947. However, some double-counting and inconsistencies in counts (e.g. hobbyist, sideliners, commercial) and reporting methods.
- Data for other managed bees (alfalfa leafcutter bees, mason bees, bumble bees) are lacking.



# Declines in managed U.S. Honey Bee Colonies



**FIGURE 2-1** U.S. honey bee colonies, 1945-2005. Data compiled from USDA-NASS (1995, 1999, 2004a, 2005a, 2006).

# Causes of Declines (*Apis mellifera*)

- *Varroa* & tracheal mites, small hive beetles, various bee diseases...
- Agricultural chemicals, stresses, migratory beekeeping.
- Loss of forage (bee pasture) and apiary sites.
- Beekeepers leaving the industry, competition from foreign honey.
- & most recently Colony Collapse Disorder (CCD)...



## NAS Recommendations: (for managed pollinators)

- Must improve & standardize info. gathering by USDA-NASS for managed honey bees
- USDA-APHIS prohibit new bee introductions (especially exotic Bombus spp.)
- Expand USDA competitive grants prgrm (including SBIR with private companies)
- USDA, Discovery surveys of crop & native plant pollinators

# NAS recommendations (Wild pollinators):

- Address taxonomic impediment, more funding for taxonomic and fast I.D. research.
- Prevent pathogen spillover (e.g. *Bombus*).
- USGS & USFWS, Discovery surveys for pollinators or rare, threat. & endg. plants.
- Federal network of long-term pollinator monitoring projects.

## Wild Pollinators (cont'd.)

- NSF & USDA **must** recognize pollination & pollinators as cross-cutting themes in their granting programs.
- Economic incentives should be expanded for pollinator/plant conservation.
- Professional societies should collaborate with land owners for pollinator/plant conservation.
- Congress should **not** consider any Endangered Species Act amendment that would create additional barriers to listing pollinators as endangered species.

# Stingless Bee (*Melipona beecheii*) & Traditional Meliponiculture Conservation in the Yucatan









# Special Thanks To:

Arthur Donovan, The Bee Works  
Dr. Rogel Villanueva, ECOSUR  
Willberto Colli-Ucan y Margarito Tuz  
(El Colegio de La Frontera Sur)  
Dr. David Roubik, STRI, Panama  
Julio Lopez-Maldonado, U.C. Davis

Melanie Adcock, CS/Mott Fund  
Diana Cohn, Solidago Foundation  
Richard Felger, Drylands Institute

# Threats to Mayan Beekeeping ( M. beecheii & M. yucatanica)

Habitat loss, fragmentation, conversion to milpa agriculture.

Loss of tall (25-30m) forests( *Melipona* selects larger diam. trees).

Aging beekeeper popl., beekeeping traditions, until recently, not taught to younger men and women.

Loss of knowledge, about dividing parental colonies into daughter ones.

Parasitic phorid flies, competition for floral resources with  
*Apis mellifera\_scutellata* (Africanized honey bees). Hurricanes, droughts.

Mexican govt. assistance programs, almost all for *Apis*.

Existing programs killing bees (lack of adequate trainers).

**TABLE 1. Number of *Melipona beecheii* hives that beekeepers from the zona Maya have kept in the last 54 years.**

Name of Mayan community	Name of beekeeper or institution	No. of hives kept between 1950 and end of 1981	No. of hives kept at end of 1990	No. of hives kept at end of 2004
Chan Santa Cruz	Delfino Naal	unknown	8	2
Chan Santa Cruz	Nemesio Pot	unknown	12	8
Chancá de Repente	Bernardo Peña	42	25	8
Chancá de Repente	Anastasio Pérez	unknown	10	0
Chancá de Repente	Eduardo Yam	unknown	5	0
Chunýá	Patricio Canul	45	30	8
Felipe Carrillo Puerto	Inst. Nacional Indigenista	0	40	8
Miztequilla	Santiago Pat	unknown	6	2
Miztequilla	Fernando Yam	40	19	8
Naranjal	Francisco Cimá	25	15	3
Naranjal	Juán Mena	26	12	6
Nueva Loría	Celestino Camal	unknown	7	2
Nuevo Israel	Ponciano Tun	unknown	6	0
Palmas	Margarito Tuz	220	5	0
Presidente Juárez	Bernabé Kantún	unknown	16	4
San Hermenegildo	Humberto Ku Cauich	60	40	0
Santa María	Francisco HuiCab	50	37	7
Señor	Doroteo Pech	22	18	0
Señor	José Pott	unknown	6	0
Tihosuco	Pedro Cahun Uh	unknown	5	12
Tuzic	Isidro Peña Tuz	200	40	8
X hazil	Modesto Chuc	10	7	0
X hazil	Isaías Cahuich	15	10	0
Yo Actún	Rancho San Martín	unknown	10	4
Totals		likely >1000	389	90

Alarming declines in managed *Melipona* colonies (also largescale deforestation & loss of wild colonies...)

From more than 1,000 jobones in  
1981  
to only 90 managed colonies in  
2004...

Villanueva-Gutierrez and Roubik  
predict traditional Melipona beekeeping  
could be **extinct** in Quintana Roo, MX  
as early as 2008!





Madrid Codex (15th Century, pre-conquest)

Description of Colony Division (Creating daughter colony from parental hive)



*etel* in companion

*yik'il kab* bees of *M beecherii*

*el yik'il kab* the eggs and larvae of *M. beecherii*

*chambil* things that fit in another      *ets'* taking position

*kanahil* which is in house of other

*ts'e* little by little (by the time)

*kahenkah* to establish their home and live separately



Akta'ol keketa' pach che'e' kab, yik'il kab nok'ol,  
 chuil pot pah k'aakbal kil etel pul lo'eb k'alani' ich keebal  
 ma'ol mak'abil olma' ilab ichil ichil noch –haw paabil.

Translated as: "Fixing and seating the same as other beehives,  
 selecting where the bee larvae will be born. The wax brood cells  
 containing the sour solution where the floating eggs mature.  
 Bring out those cells and turning aside, delightfully eating with  
 abundance, little by little. Observe carefully which hive section  
 has to be picked up and moved to a new location."





*Melipona beecheii*  
(Apidae, meliponini)



nest entrance  
with white exocrine  
secretion



Nest w/ brood & workers





Xunan Kab (*Melipona beecheii*)

QuickTime™ and a  
DV/DVCPRO - NTSC decompressor  
are needed to see this picture.

M. beecheyi guard in colony entrance...  
Look out! incoming...

QuickTime™ and a  
DV/DVCPRO - NTSC decompressor  
are needed to see this picture.

**Melipona beecheii and storage pots**









Log hive ends are plugged  
with stone or  
wooden disks and red mud

Honey extraction is easier  
with a box hive using a  
syringe...





# Melipona honey...

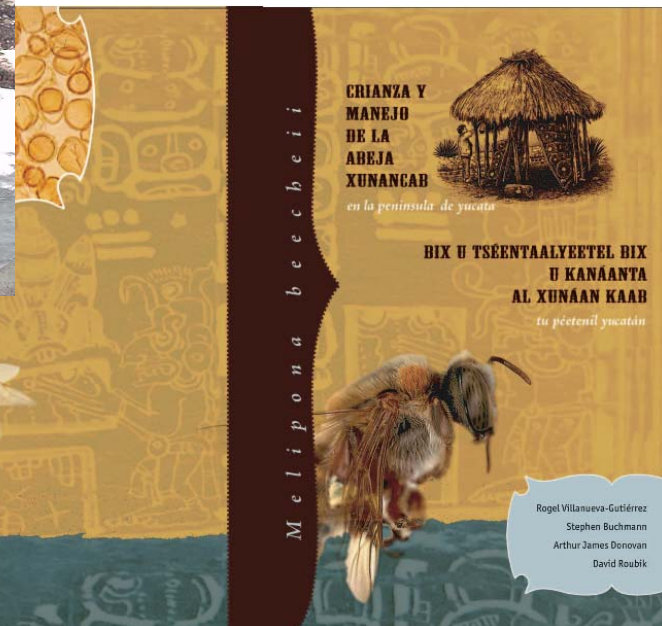
For almost 2,000 years the Maya have prized this honey for its medicinal properties (curing cataracts, sore throats, easing childbirth) and for use in ancient religious rituals...

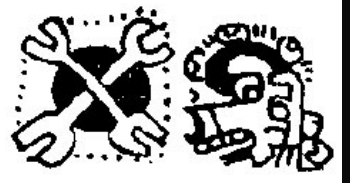
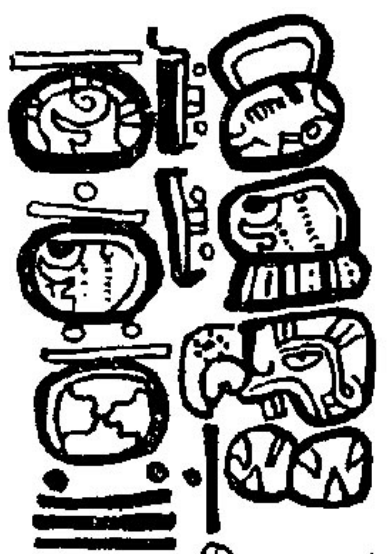
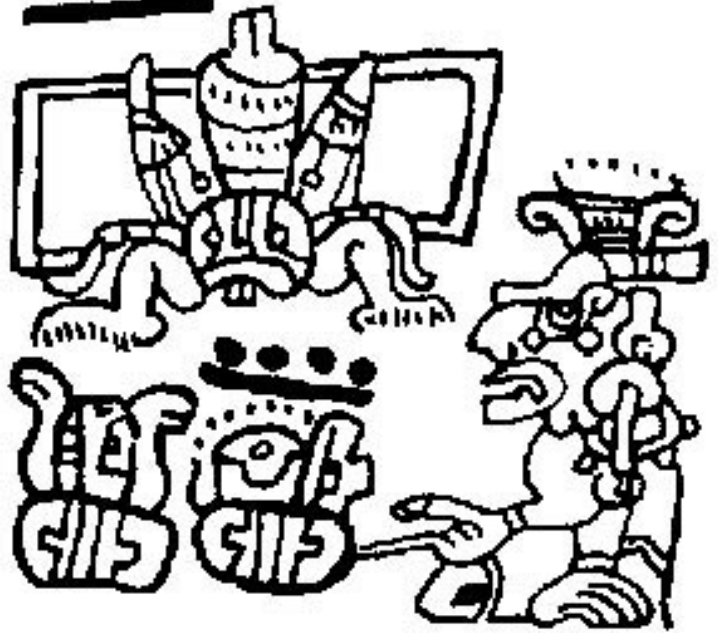
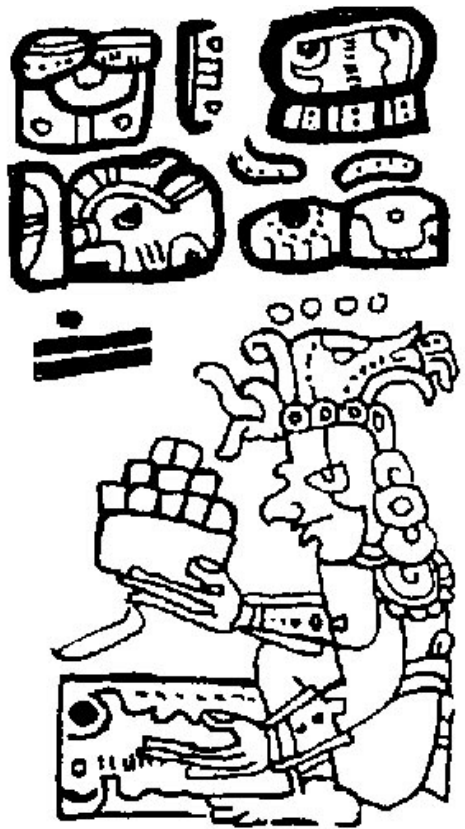
About 1-2 liters of honey can be harvested per colony each year. Mayan women are not allowed to tend the bees or take part in the rituals.

The honey is fermented into a special honey wine, "Balche". A Mayan shaman (H-men) often steeps the mixture with the bark of Lonchocarpus trees. This concoction produces colorful hallucinations and presumably happy Mayan beekeepers.



We constructed a research, demonstration & teaching Meliponario at ECOSUR in Chetumal, MX  
We created a Spanish/Mayan bilingual booklet on meliponiculture & distributed 3,000 copies









- Please visit the Pollinator Conservation Digital Library (PCDL) at [www.pollinator.org](http://www.pollinator.org)

# The North American Pollinator Protection Campaign (NAPPC)

- Founded in 2000 after “Saving America’s Pollinators Symposium at the U.S. National Zoo in 1998.
- A tri-national (Canada, USA, Mexico) consortium (>140 partner organizations) dedicated to pollinator and plant conservation.
- [www.nappc.org](http://www.nappc.org) and [www.pollinator.org](http://www.pollinator.org)
- Please join us! Become a NAPPC partner.
- Annual mtg. w/working groups in Washington, DC (late October).



# Examples of current NAPPC projects

- National Pollinator Week (June 24-30, 2007). U.S. Senate and Agric. Sec. proclamation. Trying to establish Natl. Poll. Week as an annual event.
- 8 new USA Commemorative Pollinator Stamps.
- MOU's signed with USDA, DOI, BLM, DOD. A first step to establish pollinator friendly practices on 600 million acres.
- Inter American Biodiversity Network (IABIN) Pollinators Thematic Network.



- Bee Importation White Paper (*Bombus*).
- Pollinator & native plant Friendly Practices language (Farm Bill; Boxer & Baucus Senate bills). Congressional briefings.
- NAS “garden wheel” about pollinators.

# Edward O. Wilson spoke about pollinator conservation yesterday in Washington, DC as part of National Pollinator Week

**The Partners of the North American Pollinator Protection Campaign**

*As part of National Pollinator Week*

*Invite you to attend Exclusive **Pollinator Partnership** Events featuring*

**Dr. Edward O. Wilson**

Wednesday, June 27, 2007

**10-11 AM**

***Pollinators: An in-depth Look***

Lecture with question and answer session

**Kaiser Family Foundation Public Affairs Center**

1330 G Street, NW Washington, DC

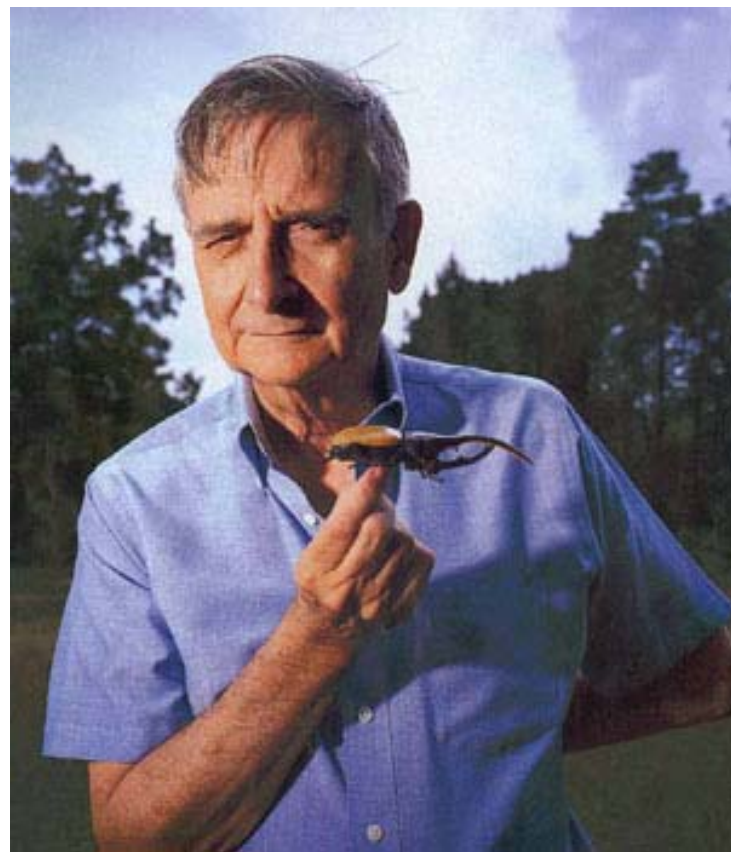
**6-8 PM**

***A Celebration of Pollinators and Professor Edward O. Wilson***

VIP Reception

**USDA Whitten Patio**

U.S. Department of Agriculture



Wilson's talk will soon be available as a podcast at [www.pollinator.org](http://www.pollinator.org)

# Pollinator Stamps

By stamp artist Steve Buchanan  
(June 29th, First Day of Issue)

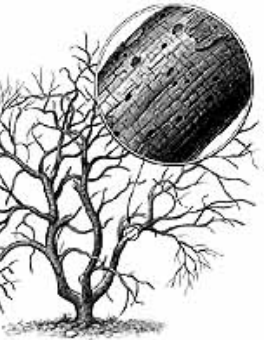


Buy lots! Let these stamps help spread the message of pollinator & plant conservation...

- NAPPC committee to Citizen Stamp Advisory Committee. Two years for approval instead of the usual ten years.

# What YOU can do.

- Join NAPPC and visit [www.pollinator.org](http://www.pollinator.org)
- Become a **wildlife gardener** for humming butterflies, bees etc.
- Get some close-focusing binoculars, go “**butterflying**” with your family.
- **Build a bee condo**, preserve dead tree limbs so that solitary bees can nest.
- **Don't use pesticides** or use them wisely.
- **Support local farmers** by buying local, especially organic produce.





# NAPPC Exhibit

- Did you pick up your FREE items from NAPPC?
- NAS pollinator & plant “garden wheel”
- Pollinator Poster (cherry blossoms & Blue Orchard Bees)
- Postcards





Questions?  
Please ask me during Coffee Break...

